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FEDERAL AVIATION ADMINISTRATION TECHNICAL CENTER ATL--ETC F/G 17/7  
NEW TOWER CAB MOCKUP FOR PHILADELPHIA, PENNSYLVANIA.(U)  
MAR 81 D BOTTOMLEY, E G EZEKIEL, R MATOS

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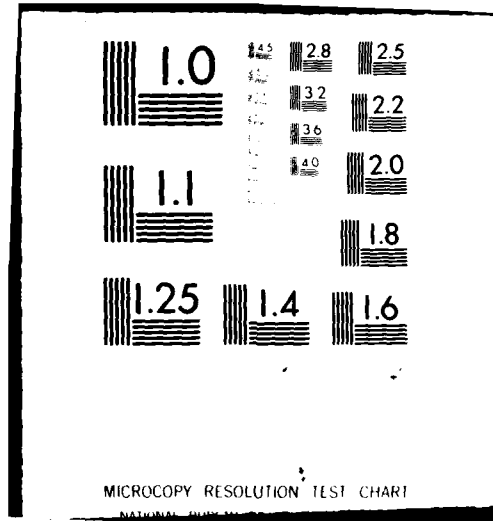
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Report No. FAA-RD-80-141  
FAA-CT-81-12

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## NEW TOWER CAB MOCKUP FOR PHILADELPHIA, PENNSYLVANIA

Donald Bottomley  
Edward Ezekiel  
Rene Matos

AD A098528

FEDERAL AVIATION ADMINISTRATION TECHNICAL CENTER  
Atlantic City Airport, N.J. 08405



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**FINAL REPORT**

**MARCH 1981**

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Prepared for

**U. S. DEPARTMENT OF TRANSPORTATION**  
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Washington, D. C. 20590

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## Technical Report Documentation Page

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16. Abstract Mockup techniques which used foamcore and plywood were employed by the Federal Aviation Administration (FAA) Technical Center to achieve two major goals in assisting the Regional Office and the Air Traffic Control Facility to establish a new control tower at Philadelphia, Pennsylvania. Goal one was to determine the best physical location of present and planned equipment for operational positions and to suggest innovations which would improve their functional capability. Goal two was to design, develop, fabricate, and evaluate the central interior console which is not common to most tower cabs and is not a standard configuration. The result of this effort was a more functional and efficient layout for a standard 525-square-foot Welton-Beckett tower cab. Several new modules were introduced to the peripheral consoles, and a unique central console was designed. A new, innovative technique was created to house the bright radar indicator tower equipment (BRITE) displays on swivel, console-height mounts.			
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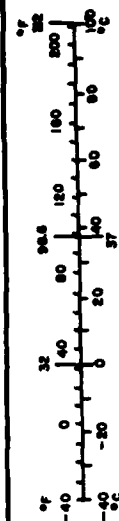
# METRIC CONVERSION FACTORS

## Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
<b>LENGTH</b>				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yds	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
<b>AREA</b>				
sq in	square inches	6.5	square centimeters	cm <sup>2</sup>
sq ft	square feet	0.09	square meters	m <sup>2</sup>
sq yds	square yards	0.8	square meters	m <sup>2</sup>
sq mi	square miles	2.6	square kilometers	km <sup>2</sup>
acre	acres	0.4	hectares	ha
<b>MASS (weight)</b>				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
short ton (2000 lb)	short tons	0.9	tonnes	t
<b>VOLUME</b>				
Imp gal	Imperial gallons	4	liters	l
U.S. gal	U.S. gallons	3.8	liters	l
qt	quarts	0.95	liters	l
pint	pints	0.47	liters	l
cup	cups	0.24	liters	l
fluid ounce	fluid ounces	2.9	milliliters	ml
tablespoon	tablespoons	15	milliliters	ml
teaspoon	teaspoons	5	milliliters	ml
fluid ounce	fluid ounces	30	milliliters	ml
cup	cups	0.24	liters	l
pint	pints	0.47	liters	l
quart	quarts	0.95	liters	l
gallon	gallons	3.8	liters	l
cubic foot	cubic feet	0.03	cubic meters	m <sup>3</sup>
cubic yard	cubic yards	0.76	cubic meters	m <sup>3</sup>
<b>TEMPERATURE (exact)</b>				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

\*1 in = 2.54 (exact). For other exact conversions and more detailed tables, see NBS Misc. Publ. 206, Units of Length and Measure, Price \$2.25, SD Catalog No. C13.1D-206.

Symbol	When You Know	Multiply by	To Find	Symbol
<b>LENGTH</b>				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
km	kilometers	1.1	miles	mi
mi	miles	0.6	miles	mi
<b>AREA</b>				
sq cm	square centimeters	0.16	square inches	sq in
sq m	square meters	1.2	square yards	sq yds
km <sup>2</sup>	square kilometers	0.4	square miles	sq mi
ha	hectares (10,000 m <sup>2</sup> )	2.5	acres	acres
<b>MASS (weight)</b>				
g	grams	0.005	ounces	oz
kg	kilograms	2.2	pounds	lb
tonnes (1000 kg)	tonnes	1.1	short tons	short tons
<b>VOLUME</b>				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m <sup>3</sup>	cubic meters	35	cubic feet	cu ft
m <sup>3</sup>	cubic meters	1.3	cubic yards	cu yds
<b>TEMPERATURE (exact)</b>				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



# PREFACE

The Federal Aviation Administration (FAA) Technical Center Program Manager was Felix F. Hierbaum, Jr., of the Air Traffic Control (ATC) Applications Branch, ACT-210. The Systems Research and Development Service (SRDS) Subprogram Manager was William Fraser, ARD-122. For further information concerning the project, contact Donald Bottomley, ACT-210, Technical Center Project Manager, (609) 641-8200, ext. 2306, or FTS 346-2306.

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## TABLE OF CONTENTS

	Page
INTRODUCTION	1
Purpose	1
Background	1
DISCUSSION	1
RESULTS	2



## LIST OF ILLUSTRATIONS

Figure		Page
1	Proposed Operational Position and Equipment Arrangement	3
2	Final Operational Position and Equipment Arrangement	4
3	Local Control with BRITE IV at Console Level, Gimbal Mounted	5
4	"L" Shaped FD/CD Island Console	6
5	Supervisory Console (Background)	7

## INTRODUCTION

### PURPOSE.

The purpose of this study was to ensure maximum efficiency of the overall air traffic operation by continually permitting technical and operationally oriented personnel to evaluate the proposed tower cab design and configurations through use of a full-scale, mockup technique.

### BACKGROUND.

Control of air traffic at the Philadelphia (PHL) International Airport has been provided by personnel of the Federal Aviation Administration (FAA) Airport Traffic Control Tower located on top of the airport terminal building. This present control tower structure is a four-sided tower cab, now outmoded.

The new air traffic control tower, a 525-square-foot Welton-Beckett octagonal cab, is being built to replace the present tower cab. This new structure, with its associated base building, is to be located on the south side of the field.

Facility personnel had been working on a plan for operational position and equipment arrangements in the new tower, which was designed to enhance the PHL air traffic operation. The FAA Technical Center was requested to assist in this effort with the following objectives:

1. Provide a full-scale mockup of the proposed tower console arrangement in a realistic tower cab environment.
2. Develop, evaluate, and modify, as required, an equipment and positional arrangement plan suitable for PHL.

## DISCUSSION

A full-scale mockup of a Welton-Beckett 525-square-foot tower cab (see figure 1) was constructed in the Technical Center's Air Traffic Control (ATC) Facilities Configuration Laboratory. The mockup was made of foamcore and wood. All equipment on the consoles was either actual or a facsimile faceplate of equipment; i.e., when some equipment was not available, actual size photographs or cardboard cutouts were used.

Operational input to the study was accomplished by bringing teams of air traffic controllers from the PHL facility to the Technical Center to evaluate placement of equipment. Each group was briefed on all facets of the plan and provided with the opportunity to stand or sit at the various operational positions. Their determinations were taken into consideration on the many aspects of the modernization plan.

The initial test concept reflected the following operational positions:

1. Two Ground Control (GC)
2. Two Local Control (LC)
3. Two Local Control Coordinators (LCC)
4. One Terminal Control Area (TCA)
5. One Flight Data/Clearance Delivery (FD/CD)
6. One Supervisor

With the exception of the TCA, all control positions faced an active runway. The GC positions were located in the middle, the LC's were located in the corners using bright radar indicator

tower equipment (BRITE) IV displays at console level, gimballed, and the LCC's were located on the outside of the LC positions. The TCA was located adjacent to the LCC position (along one side of the tower cab).

## RESULTS

Modifications were made to the tower consoles, and movement of some equipment was made at the request of PHL tower personnel. In addition to modifications to the tower consoles, a request was made by tower personnel for a new approach to the Flight Data/Clearance Delivery (FD/CD) console in the center of the cab. A standard console, seating two persons, was judged totally inadequate for the joint FD/CD position. To this end, a new console was designed which could accommodate the FD/CD position and associated equipment and still provide some storage space.

During the study, continuing changes were made to planned positions and respective equipment. To partly expand on the previously cited positions, initially there were to be two LC's, each with a BRITE IV radar console, two GC's with one Airport Surface Detection Equipment (ASDE), and one TCA with a BRITE IV. Because of the evaluation, the mockup configuration was later changed, at the request of PHL and Regional Office personnel, to one GC with an ASDE. The two LC's were still at the corners facing an active runway,

each with a BRITE IV at console level on a pedestal, gimballed mounted. (See figures 2 and 3.) The LCC's were placed on each side of the GC beside the LC. The TCA controller was relocated to the LC position not in use at the time, and all positions faced an active runway.

The FD/CD console has also undergone numerous changes. It originally was a standard FD/CD, which was totally inadequate for the PHL facility. It was modified to a "U" shape, a half-moon shape, and finally to an "L" shaped console. The "L" shaped island was favorably accepted by the PHL tower and Eastern Region personnel. (See figure 4.)

The Supervisory console had been tentatively accepted, but modifications were then required at the request of facility personnel. The bookcase was relocated from the right side to the left side of the console. (See figure 5.)

There will be no requirements for waivers by the Eastern Regional Office. The modifications made on the consoles have been accepted, and placement of actual instrumentation will be finalized by the facility at a later date.

## CONCLUSION

It was concluded that the console design as fabricated and evaluated by the Technical Center was feasible.

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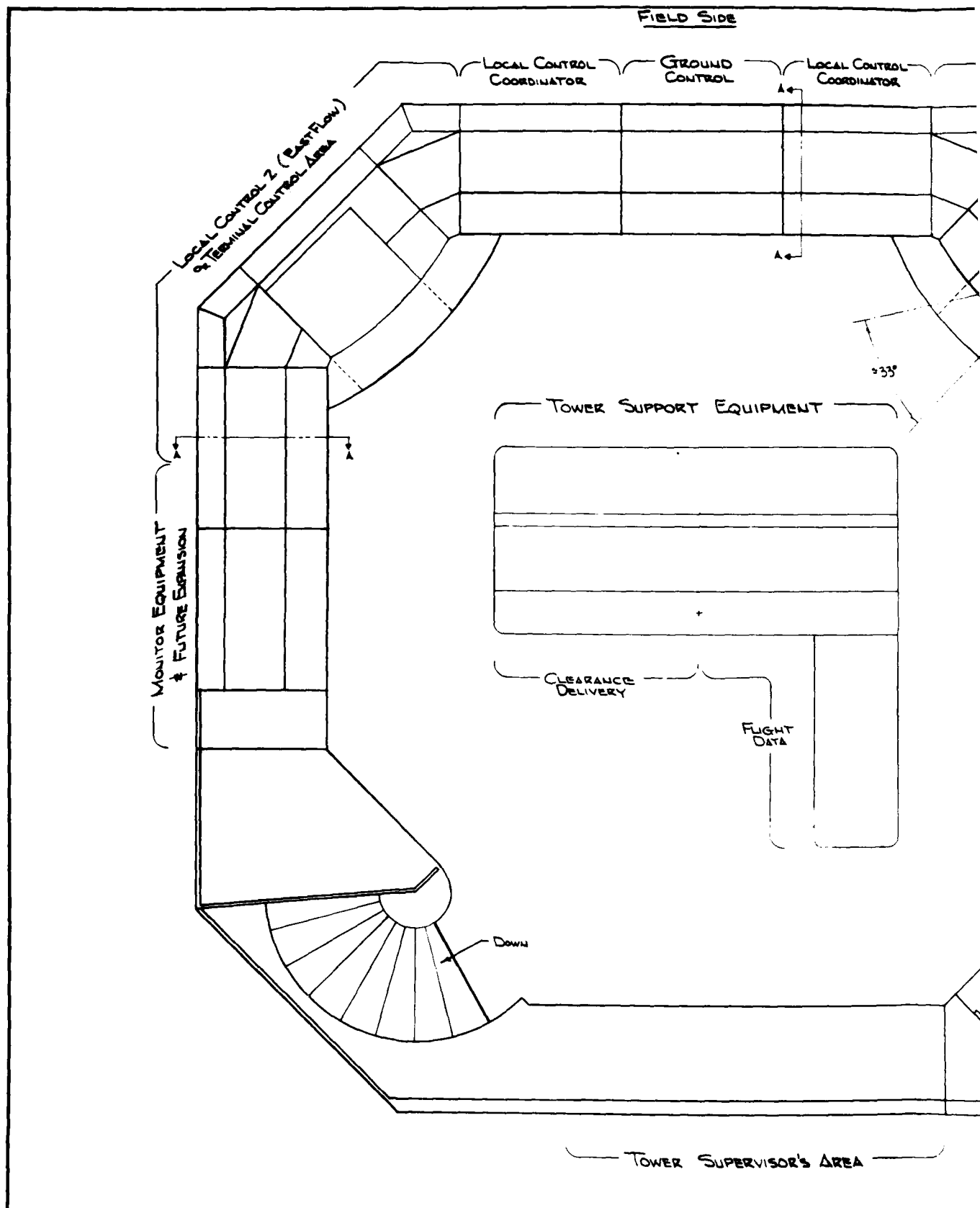
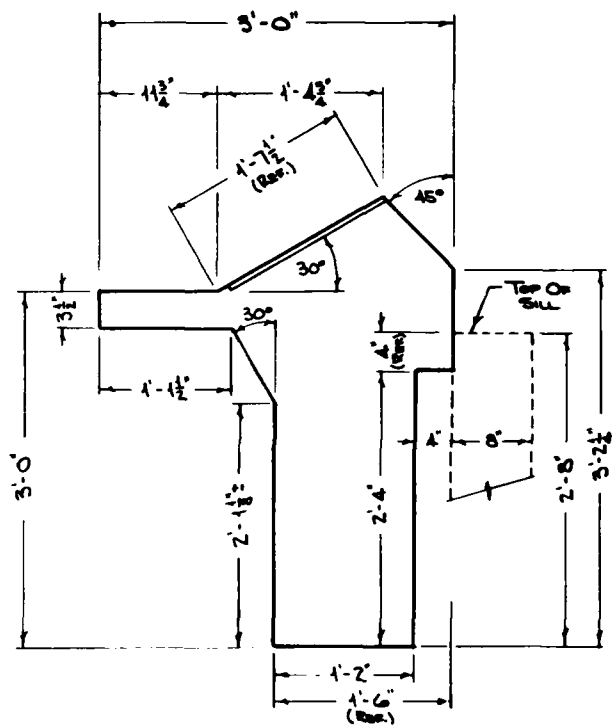
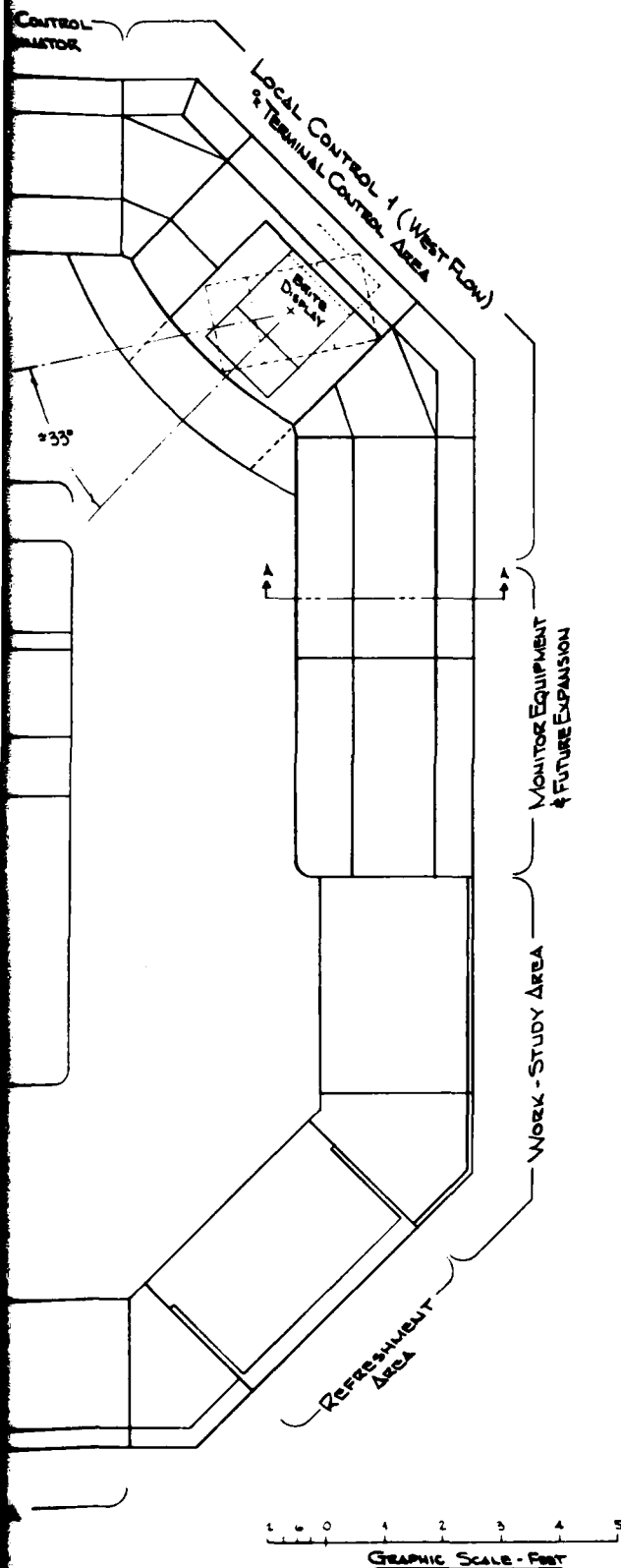


FIGURE 1. PROPOSED OPERATIONAL POSITI



SECTION A-A  
PROPOSED CONSOLE - SIDE ELEVATION

REV	DATE	DESCRIPTION	DESIGNED BY	APPROVED
<p align="center"><b>FEDERAL AVIATION ADMINISTRATION</b>          NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER      ATLANTIC CITY, N.J.</p>				
<p align="center"><b>PHILADELPHIA INTERNATIONAL AIRPORT</b>  <b>CONTROL TOWER LAYOUT</b>  <b>PROPOSED POSITIONS OF OPERATION</b></p>				
DESIGNED BY	<p align="center"><b>ACT-210</b>          SUSTAINING ENGINEERING</p>		<p align="center"><i>James Bottomley</i>          DONALD BOTTOMLEY</p>	
DATE	<p align="center"><b>ACT-63C</b>          TECHNICAL ILLUSTRATION</p>		<p align="center">DATE 11-25-80  <b>XD-3088</b></p>	

PROPOSED POSITIONS OF OPERATION AND EQUIPMENT ARRANGEMENT



FIGURE 2. FINAL OPERATIONAL POSITION AND EQUIPMENT ARRANGEMENT





FIGURE 3. LOCAL CONTROL WITH BRITE IV AT CONSOLE LEVEL, GIMBAL MOUNTED

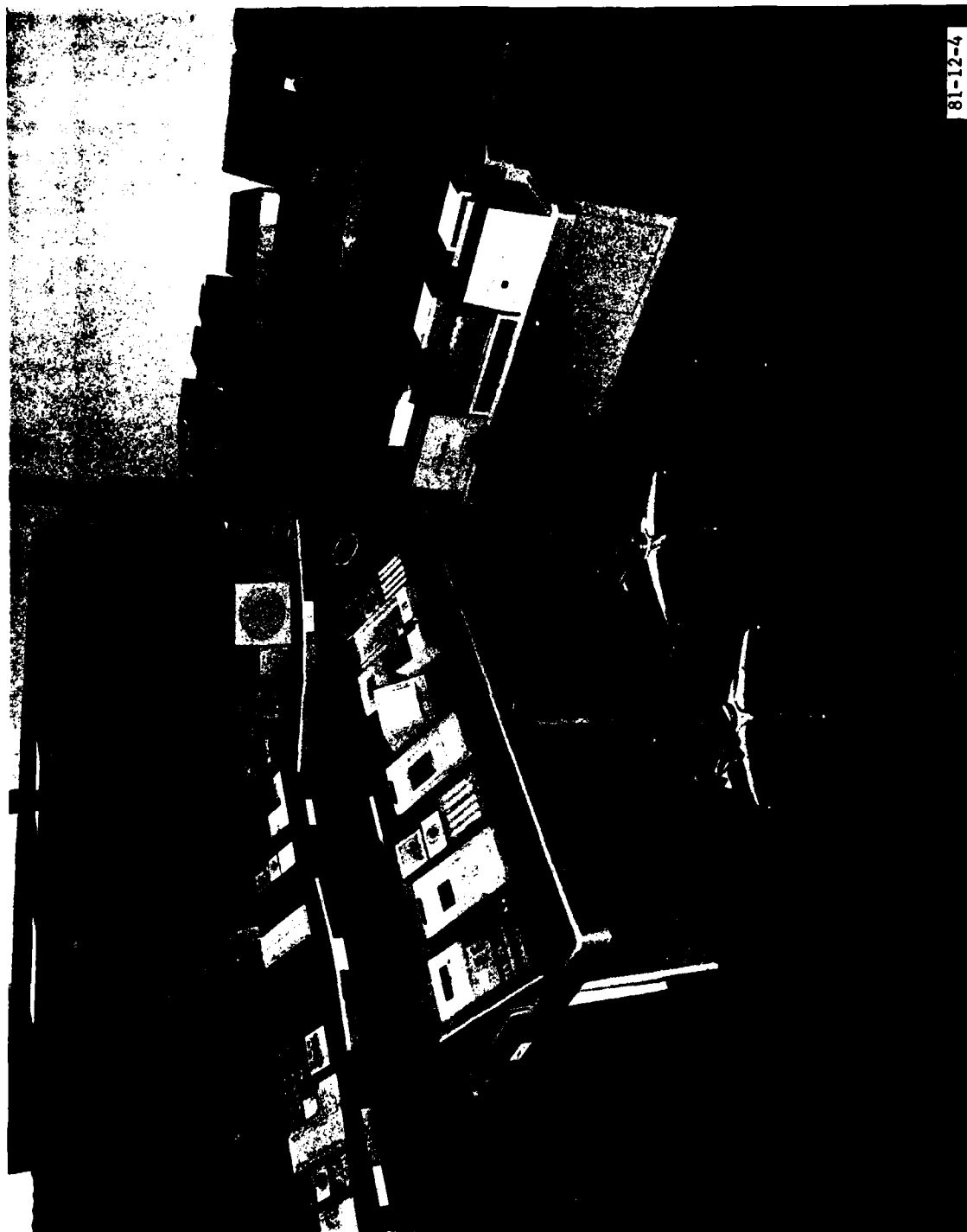


FIGURE 4. "L" SHAPED FD/CD ISLAND CONSOLE



FIGURE 5. SUPERVISORY CONSOLE (BACKGROUND)